USAF Manufacturing Technology

Status Report

Air Force Research Laboratory / Materials & Manufacturing Directorate /
Manufacturing Technology Division / Wright-Patterson AFB, Ohio
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The Air Force ManTech display was one of many at DMC '99.

Spring
2000

Manufacturing Technology USAF

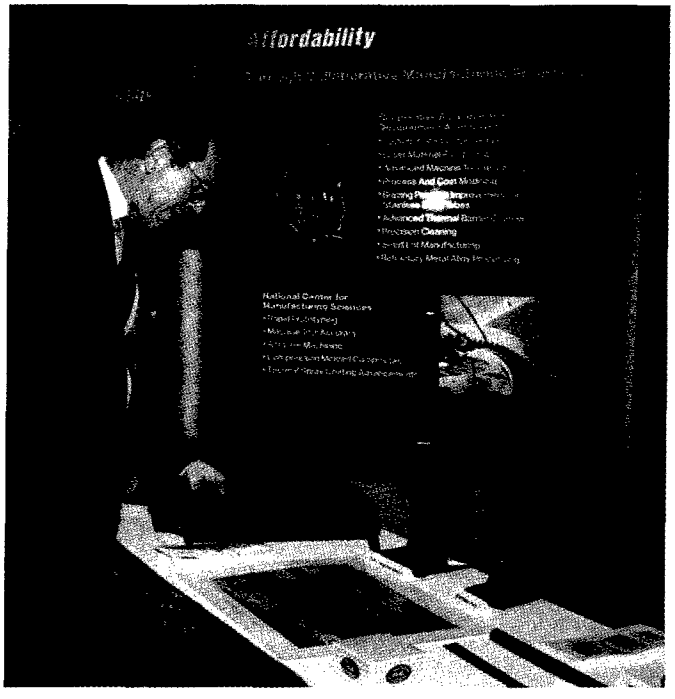
In this issue:

Defense Manufacturing Conference Draws Government, Industry, Academia To Miami

More than 790 representatives from the government, academia, and industry gathered in Miami Beach, Fla., recently, for the 1999 Defense Manufacturing Conference.

The Manufacturing Technology Division (ManTech) of the Air Force Research Laboratory Materials and Manufacturing Directorate played a major role in the event, which took place Nov. 29 through Dec. 2, at the Fontainebleau Hilton Resort and Towers. The theme for this year's conference was "Manufacturing Into The New Millennium."

DMC '99 was a forum for presenting and discussing initiatives aimed at addressing DoD manufacturing technology and sustainment needs. It provided an overview of defense manufacturing, which included detailed discussions related to various manufacturing initiatives, sustainment programs, and current technology thrusts. Perspectives and information about critical DoD manufacturing technology initiatives were exchanged and the status of industry and government programs was presented with a vision for the future of defense manufacturing and industrial modernization.



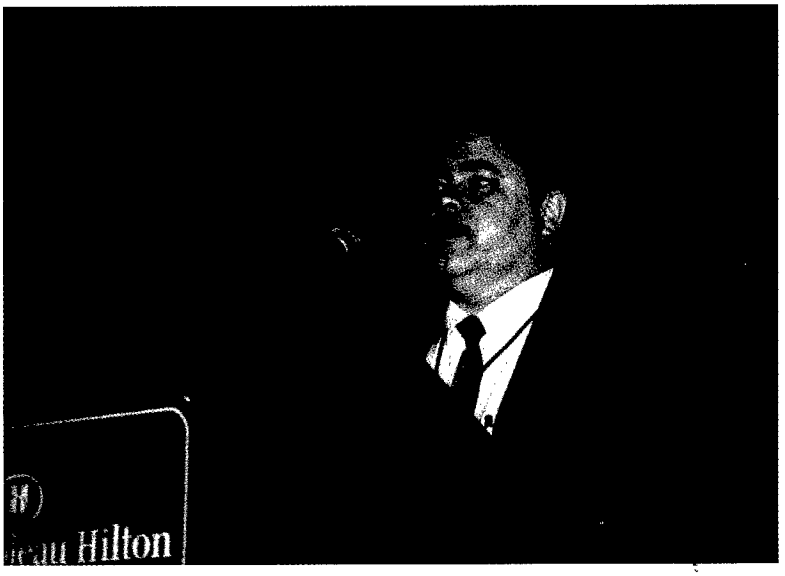
Under Secretary of the Navy, Jerry M. Hultin looks at materials on display at DMC '99.

The conference was hosted by the Joint Defense Manufacturing Technology Panel. This panel identifies and integrates requirements, conducts joint program planning, develops joint strategies, and oversees the execution of manufacturing technology and sustainment programs.

Approximately 138 government and industry exhibits were on display for the duration of the conference. The ManTech display played a prominent role, highlighting current programs which reduce weapon systems cost and enable advanced performance. Much of the conference centered around technical sessions and mini-symposiums, addressing metals processing, composites processing, electronics processing, manufacturing and engineering systems, sustainment, advanced manufacturing, best manufacturing practices and several special topics.

The conference host, Rear Admiral Paul G. Gaffney II, chief of Naval Research, gave the welcoming remarks. He was joined by the Navy keynote speaker, The Honorable Jerry M. Hultin, under secretary of the Navy, and Department of Defense keynote speaker, Joseph J. Eash III, deputy under

secretary of Defense. Other general session speakers included Richard K. Sylvester, director of Systems Acquisition, Office of the Deputy Under Secretary of Defense; John W. Douglass, president of Aerospace Industries Association; Mick L. Blackledge, technology director for the Navy Program Executive Office Theater Surface Combatants Organization; Jim Mattice, Universal Technology Corporation; and Col. Thomas P. Kelly, project manager for Night Vision/ Reconnaissance, Surveillance and Target Acquisition.



Air Force ManTech Chief Daniel J. McDermott was one of the speakers at DMC '99.

Many ManTech people were directly involved in the conference. Rollie Dutton briefed on the Engine Supplier Base Initiative and on Metals Affordability Initiatives. Kevin Spitzer moderated a session on Affordable Metals Manufacturing. Dr. Frances Abrams discussed Future Directions for Air Force Composites ManTech and was the moderator for a session on Electron Beam Technology. Brian Moore briefed on Manufacturing for Sustainment and helped moderate a session on Electronics Total Cost of Ownership. Dennis Hager was moderator for a session on the Composites Affordability Initiative.

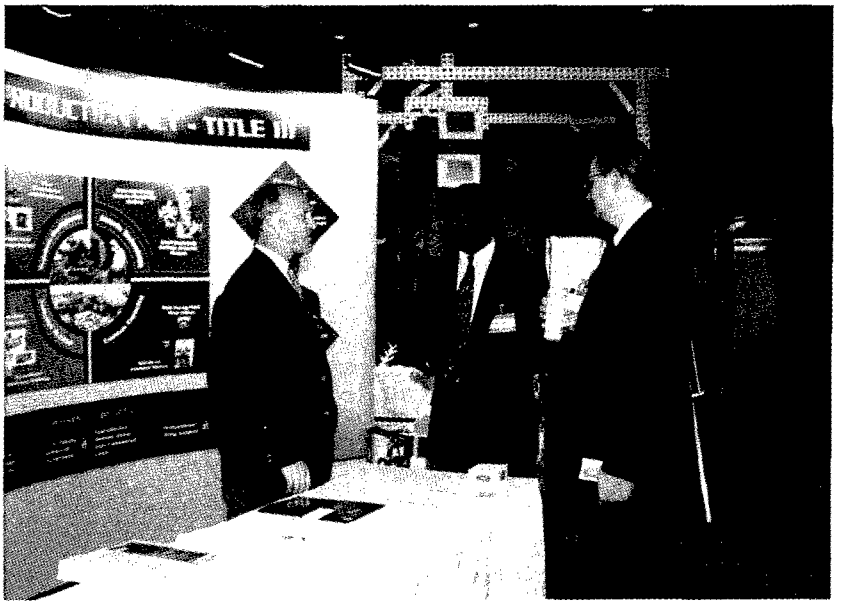
Dick Remski sat on a government and industry panel which discussed the Future Opportunities of Manufacturing Technology. Mike Marchiando helped moderate a session on Affordable Solid-State Radar Systems for Air and Space Superiority and Chuck Wagner helped

DMC '99 Proceedings Available

The proceedings of the 1999 Defense Manufacturing Conference are now on line of the Department of Defense ManTech web site at **http://mantech.iitri.org/pubs/DMC99Pro/Index.html.** Included are:

- Fifteen presentations from the plenary sessions
- Two technical session presentations that were not included on the tech session compact disk
- Information on the winners of the Defense Manufacturing Excellence Award
- Information on the winners of the Defense ManTech Achievement Award
- A list of the best technical presentations made during the mini-symposia

This year, DMC 2000 will be held in Tampa, Fla., November 27-30.



ManTech's Jeff Smith (left) and James Neely (center) address a participant's questions at their Title III display during DMC '99.

moderate a discussion on Affordable Microelectromechanical Systems for Inertial Measurement.

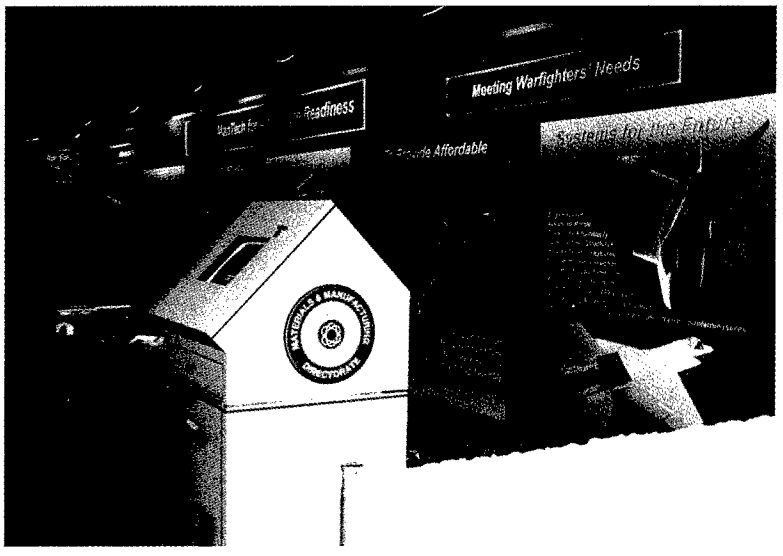
Dave Judson briefed on the Weapon System Integrated Cost Model For Decision Making in Affordability and Cost Management. Brench Boden was the technical session co-chair for Advanced Manufacturing Enterprise and also moderated a session on Achieving the Lean Enterprise. John Cantrell gave a Lean Aerospace Initiative update and Laura Leising spoke on Lean Depot Repair. Persis Elwood was the technical session chair for the Sustainment Readiness Working Group and also moderated a session on Reducing Cost of Ownership Through Failure Avoidance.

Jeff Smith was the technical session co-chair for the Defense Production Act Title III and moderated a session on Current Government Industry Partnerships for Critical Defense Technologies. John Blevins briefed on Silicon Carbide Substrates, Eric Pohlenz spoke on Silicon on Insulator Technology, and Phil Tydings addressed both Power Semiconductor Switching Devices and Laser Eye Protection.

Former ManTech Director, Dr. William C. Kessler, now vice president of Enterprise Productivity at Lockheed Martin Aeronautical Systems, gave a presentation, as did C-17 Program Director, Col. Ted Bowlds. John F. Phillips, vice president Aftermarket and

Former Air Force ManTech Director William Kessler also spoke at DMC '99.

Growth, Allied Signal, spoke at a group breakfast. Maj. Gen. Charles C. Cannon, Army deputy chief of staff for Logistics, moderated a Sustainment/ Readiness Working Group panel. He was joined on the panel by: James M. Sinnett, Boeing vice president for Strategic Development; Daniel Mullally, Federal Air Express senior vice president Worldwide Sales; Rear Admiral Roland B. Knapp, director of Fleet Maintenance, U.S. Atlantic Fleet; Maj. Gen. Dennis G. Haines, director of Combat Weapon Systems, Air Combat Command; and Randy Fowler, staff assistant, Office of the Deputy Under Secretary of Defense (Logistics) Material Management Policy.



The ManTech kiosk was part of the large Air Force ManTech Display.

Integrated Modeling and Simulation Tools Save Money, Time in Aircraft Design

The Simulation Assessment Validation Environments (SAVE) program is a new approach to separating low cost from high volume in military aircraft manufacturing.

Under a contract with the Air Force Research Laboratory Materials and Manufacturing Directorate, Lockheed Martin Corporation successfully demonstrated Virtual Manufacturing, integrating modeling and simulation tools to assess the impacts of product and process decisions on the affordability of advanced strike warfare technology. These simulation tools will allow optimal decisions to be made in the design and manufacture of new aircraft.

Military aircraft manufacturing does not enjoy the traditional cost benefits of mass production because mass quantities are not usually required. Virtual Manufacturing (VM) supports the concept of separating low cost from high volume by applying modeling and simulation technology to prove out and select optimal new concepts. The SAVE program is a first step in realizing the near-term objectives common to VM and the Joint Strike Fighter (JSF) program. This effort focused on initial implementation of VM strategically applied to specific real fighter or attack aircraft design and production affordability problems.

The initial phase of the program established a core tool suite integrated via the Defense Advanced Research Projects Agency-developed Rapid Prototyping of Application Specific Signal Processors architecture. The core tool suite incorporates commercial computer assisted design, factory simulation, assembly simulation, schedule simulation, and cost and risk modeling capabilities. In Phase I of SAVE, the core VM capabilities were validated, performance and business metrics were identified against real production problems, and areas for continued refinement and enhancement were identified. Under Phase II, the SAVE team developed a Common Object Request Broker (CORBA) based approach to tool integration which provides a solid foundation for ultimate production use and commercialization of SAVE.

The CORBA-based infrastructure now includes the SAVE Common Data Model, a work flow manager, and a query system for interactive access to the data model. In addition, commercially available dimension and tolerance simulation capabilities have been added to the VM environment.

The SAVE infrastructure was twice demonstrated during re-design activities for the F-22. The second SAVE demonstration showcased the revised SAVE server and tool kit applied to the re-design of the F-22 gun port. This gun port and surrounding skin experienced erosion problems due to muzzle blast when the gun was test fired, necessitating a redesign. The design alternatives were analyzed within the SAVE environment, manufacturing simulations were performed and cost, schedule and risk for each of the alternatives were assessed. This demonstration established SAVE's ability to operate in a distributed heterogeneous computing environment while providing meaningful manufacturability and affordability feedback to F-22 gun port IPT engineers.

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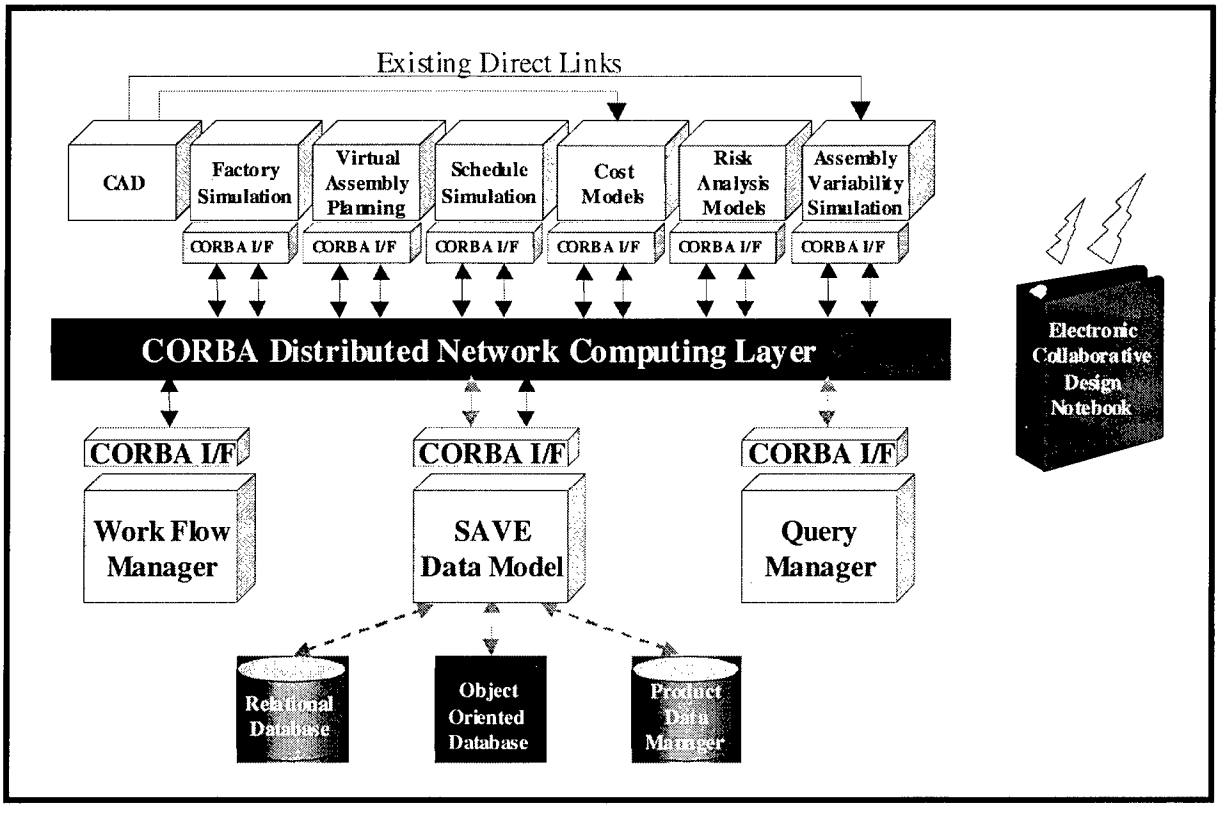
The third SAVE demonstration applied the final revision of the SAVE server and toolkit to the optimization of the F-22 weapons bay door assembly and its installation onto the aircraft. Experiences with the installation of the first three doors showed they were not meeting engineering mismatch tolerance requirements when installed on the aircraft. The solution to this problem is compounded by the fact that the doors and midbody are built in Fort Worth, Texas, while they are installed months later in Marietta, Georgia. Here, the integrated suite of modeling and simulation tools was able to provide critical tolerance and tooling feedback to the F-22 engineers in order to correct the identified weapons bay door mismatch.

The SAVE program software and development specifications are being transitioned to industry via the Modeling and Simulation standards community. Additionally, the first commercial software product based on SAVE, Cognition's Knowledge Center, was recently released.

Successful implementation of this technology in the manufacture of new weapon systems will result in better quality and reliability, improved flexibility in product changeovers, shorter cycle times, increased effectiveness, and lower cost. As a result of the SAVE Program's enhanced virtual design and manufacturing environment and tools, the program's benefits forecast a potential savings of one percent to the F-22 current air vehicle average unit cost, or approximately $716K/aircraft. For a new acquisition system like JSF, the potential benefits are projected to be between two and three percent of the total Life Cycle Cost, or a potential total cost avoidance of over $1 billion.



North American Technology and Industrial Base Organization Releases Study

The North American Technology and Industrial Base Organization (NATIBO) has released its industrial base study on Rechargeable Battery/Systems for communication and electronic applications.

The NATIBO completed a sector study assessment of the overall battery industrial base in August 1994. Since then, several significant developments have occurred influencing the military unique non-rechargeable sector of the battery production base. This production base has eroded due to reduced peacetime demands, caused by the downsizing of the forces and the high operating costs associated with using non-rechargeable batteries. These costs have driven the U.S. Department of Defense (DoD) and the Canadian Department of National Defence (DND) to increase significantly the use of rechargeable batteries during operations other than war. This increase is also partly attributed to the substantial advances in rechargeable battery technologies that make their use in tactical situations more practical. The DoD and DND anticipate the use of rechargeable batteries and chargers to expand in the future due to the potential cost savings and the growing use of manportable equipment.

The NATIBO study of the rechargeable battery and battery charger technology and industrial base highlights the state-of-the-art and future trends of this technology and industrial base as well as the ability of this industry to meet future military communication and electronic requirements.

The objective of the study was to compare the current trends in the commercial rechargeable battery and battery charger markets to the requirements of the military. It assessed which battery and battery charging technologies will be required/desired for military communication and electronic equipment and to analyze the North American technology and industrial base capability to produce the type and quantities of rechargeable batteries required by the DoD and DND. The report identifies a number of recommendations that could facilitate a successful full-scale transition to rechargeable batteries for fulfilling military communication power needs.

The NATIBO is chartered to foster cooperative planning and technology and industrial base program development among and between the U.S. military services and the Canadian Forces. With this mission, the NATIBO conducts analyses of technology industrial sectors to tell the strategic picture and pinpoint what is needed to transition the technology to market and implement it in both defense and commercial systems. The NATIBO then maps out a plan of action for implementing the concrete initiatives that are cited in the report.

For further information on this report or other documents prepared by the NATIBO, contact Mrs. Cynthia Gonsalves at (703) 681-5459 or Mr. Michael Slack at (631) 995-7224. Copies of all NATIBO studies can be downloaded from the NATIBO website at http://www.dtic/mil/natibo.

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The NATIBO display at DMC '99

NATIBO Leverages Dollars, Resources, Commercializes Emerging Technologies

As a result of NATIBO sector studies, insertion projects have been undertaken where the NATIBO has determined that the payoff of such an effort will help the technology pave the way towards commercialization and provide benefits to DoD systems.

The NATIBO's work has spawned a number of collaborative efforts including cost-saving joint procurements. Sharing and exchanging information results in joint use of databases, insights into technological breakthroughs, and product and process improvements.

The NATIBO effectively leverages dollars and resources, capitalizing on scarce resources by reducing redundant efforts through tri-service/bilateral cooperation. The organization is able to garner high-level government visibility and endorsement of technology and industrial base initiatives. Through their workplan, the group focuses on achieving rapid technology insertion and commercialization of emerging technologies.

The Air Force ManTech NATIBO project engineer is Al Moore. He can be reached at (937) 255-5096.

Joint Air Force and Central State University Project Improves Manufacturing Technology Workforce

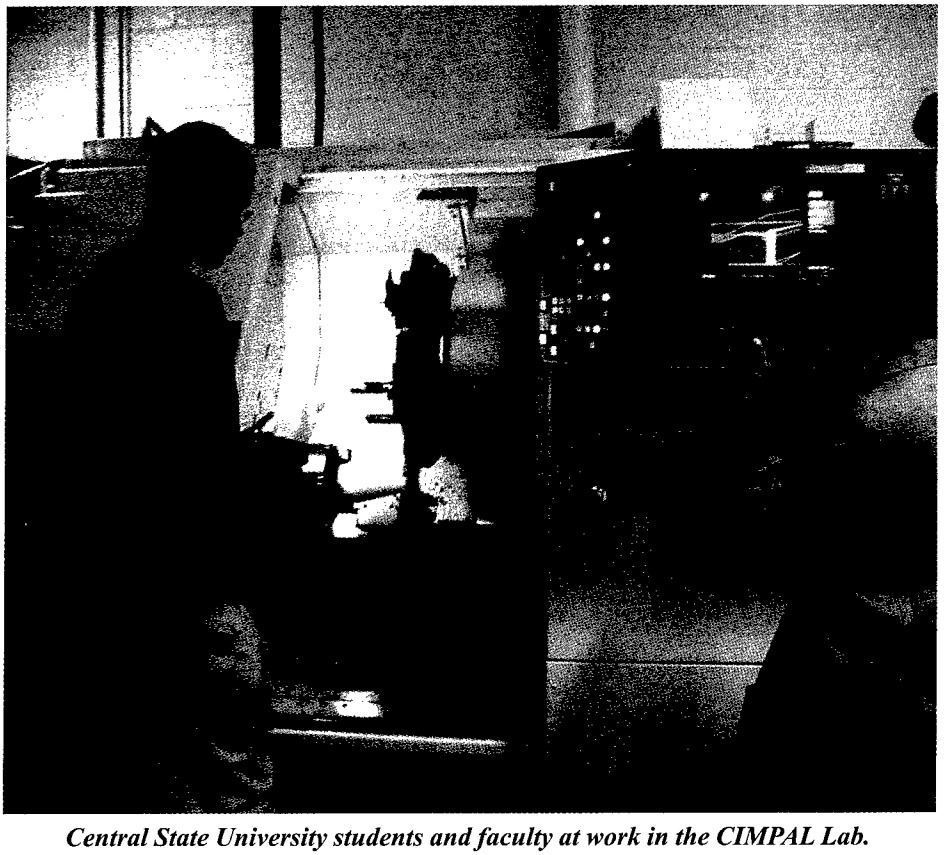
Under a contract with the Air Force Research Laboratory Materials and Manufacturing Directorate (ML), Central State University (CSU) developed a computer integrated manufacturing laboratory that will help better prepare the workforce that contributes to the nation's sophisticated technological defense requirements.

The Cell for Integrated Manufacturing, Protocols, Architectures and Logistics (CIMPAL)

project played a major role in CSU's achieving accreditation from the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology. This was one of the nation's first of such programs to be so recognized.

Manufacturers face difficulties finding talented and skilled workers and engineers. To maintain and increase global competitiveness of U.S. manufacturing, it's critical for the industry to address the education of its current and future workforce. Companies must upgrade and improve the skills of current manufacturing employees, attract the brightest and the best to the manufacturing field, and ensure the educational system develops appropriate curriculums.

This Air Force Manufacturing Technology (ManTech) project was conceived in response to an announcement soliciting proposals from Historically Black Colleges and Universities (HBCU's) and Minority Institutions (MI's) for activities that would enhance their ability to address Air Force needs relative to research and development. Central State University is Ohio's only predominantly African-American, state-assisted institution of higher education and the nation's only HBCU with a self-contained bachelor of science degree program in manufacturing engineering. Moreover, CSU's existing Manufacturing Engineering (MFE) Department possessed considerable technical expertise and physical resources to support manufacturing research. These factors, along with CSU's strategic



Central State University students and faculty at work in the CIMPAL Lab.

campus location within a 30-minute drive from ML, uniquely qualified the university to address the objectives of the announcement.

For this project, Central State University supplemented its team of university faculty members and student research assistants with consultants from two industrial and technology firms: Cincinnati Milacron, of Cincinnati, Ohio; and, Automation Research Systems Ltd. (ARS), of Alexandria, Va. An operational laboratory was established at CSU which provides for automated design, machining, welding and inspection. This site has been used to conduct manufacturing research, carry out technology demonstrations, deliver classroom instruction for programs in engineering and technology, present specialized hands-on training workshops in computer-aided design and manufacturing (CAD/CAM), and support a collaborative effort with local industry to manufacture components for an aerospace test program.

The effort combined existing design and process planning resources into an integrated system. A Cincinnati Milacron 1208C Computer Numerical Control (CNC) Turning Center with Acramatic 950 Controller was acquired and installed. An Arrow 750 vertical machining center, a Brown & Sharpe Coordinate Measuring Machine, and a Shroff JP System 5 Rapid Prototyping system were also acquired and incorporated in into the CIMPAL cell. Several shop floor simulation packages were implemented for demonstration in the CIMPAL laboratory and introduction in the engineering curriculum. A two-day training workshop was developed to provide a hands-on overview of CAD/CAM technology for presentation to small manufacturers. This was presented many times to veterans, veteran-owned businesses and small manufacturers.

Central State University students and faculty at work in the CIMPAL Lab.

The CIMPAL project contributed greatly to the physical resources and expertise available at Central State University for delivering manufacturing engineering and technology education. The program enhanced regular classroom and laboratory instruction as well as support for student research projects, and also enhanced the university's ability to conduct research relative to modern manufacturing technology. Resources and expertise acquired through this effort were leveraged to attract additional research projects from government agencies. Graduates of this program have carried their manufacturing knowledge on to many of the nation's graduate engineering programs and to diverse manufacturing industries.

Project Engineer:
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(937) 904-4387

END OF CONTRACT FORECAST

DATE	PROJECT TITLE CONTRACT NO.	PRIME CONTRACTOR	POINT OF CONTACT
April 2000	Microwave Curing for Reversible Bonding of Composites F33615-98-C-5115	Aerotech Engineering & Research Company Lawrence, KS	Frances Abrams (937) 904-4380
April 2000	Advanced Manufacturing Technology Feasibility Demonstration 2 F33615-96-D-5608	Anteon Corporation Dayton, OH	Phil Tydings (937) 255-3701
April 2000	Advanced Manufacturing Technology Feasibility Demonstration 3 F33615-96-D-5101	General Research Corporation International Vienna, VA	Phil Tydings (937) 255-3701
April 2000	Modular Factory for Electronic Warfare (EW) Component Manufacturing F33615-95-2-5564	Northrop Grumman Corporation Rolling Meadows, IL	Brenchley Boden (937) 904-4399
May 2000	Laminated Object Manufacturing-Based Design for Ceramic Composites F33615-98-C-5121	Northrop Grumman Corporation Bethpage, NY	Jon Jeffries (937) 904-4353
May 2000	Weapon Systems Integrated Cost Model (WS-ICM) - Production Cost Model (PCM) F33615-98-C-5137	Wallace & Company Greensboro, NC	David Judson (937) 904-4590
May 2000	Mixed Signal Test (MiST) F33615-95-2-5562	Boeing Company Seattle, WA	William Russell (937) 904-4583
June 2000	Molecular Beam Epitaxy (MBE) Processing Control N/A	TechnoSoft Incorporated	Steven LeClair (937) 255-8786
June 2000	Identification & Quantification of Structural Damage (Structural Repair of Aging Aircraft) F33615-97-2-5151	Northrop Grumman Corporation El Segundo, CA	Michael Urig (937) 904-4384
June 2000	Flexible Environment for Conceptual Design F33615-96-C-5617	Rockwell International Corporation Palo Alto, CA	Eugene Himes (937) 904-4356
June 2000	Simulation Assessment Validation Environments F33615-95-C-5538	Lockheed Martin Corporation Fort Worth, TX	James Poindexter (937) 904-4351
July 2000	Structural Repair of Aging Aircraft F33615-98-2-5113	McDonnell Douglas Corporation St Louis, MO	Deborah Kennedy (937) 904-4392
July 2000	Hybrid Composites Manufacturing Technology for Braiding/Filament Winding F33615-98-C-5153	A&P Technology Incorporated Covington, KY	Eric Becker (937) 904-4382
July 2000	Breathable Release Coatings for Ceramic Tooling F33615-98-C-5159	Utility Development Corporation Livingston, NJ	Eric Becker (937) 904-4382
July 2000	Titanium Matrix Composite Turbine Engine Component Consortium (TMCTECC) F33615-94-2-4439	United Technologies Corporation West Palm Beach, FL	Kevin Spitzer (937) 904-4599

DATE	PROJECT TITLE CONTRACT NO.	PRIME CONTRACTOR	POINT OF CONTACT
August 2000	Combat Survivor Evader Locator (CSEL) Module Improvement Process F33615-99-C-5508	Alliant Techsystems Incorporated	Charles Wagner (937) 904-4591
August 2000	Development of a Composite Material Selection Advisor (CoMaSa) F33615-99-C-5703	Florida International University Miami, FL	Steve Medeiros (937) 255-8787
August 2000	Rapid Coater for Laser Shock Peening F33615-98-C-5116	LSP Technologies Incorporated Dublin, OH	David See (937) 904-4387
August 2000	Parts Obsolescence Management Tool for Out Production Parts F33615-98-C-5129	TRW Incorporated San Diego, CA	Theodore Finnessy (937) 904-4344
August 2000	Computer Enhanced Eddy Current Detection F33615-98-C-5154	American Research Corporation of Virginia Radford, VA	Michael Urig (937) 904-4384
August 2000	Optimal Pre-Stressing Surfaces by Superfinish Hard Turning for Maximum Fatigue Life Multiple Contracts	Purdue University West Lafayette, IN	David Judson (937) 904-4590
August 2000	Robust Scheduling and Diagnostics Using Simulation-Based Optimization Numerous Contracts	Georgia Institute of Technology Atlanta, GA	David Judson (937) 904-4590
August 2000	Light Detection And Ranging (LIDAR) Wind Sensor Manufacturability F33615-97-C-5145	Coherent Technologies Incorporated Charleston, SC	Walter Spaulding (937) 904-4365
September 2000	Advanced Manufacturing Technology Feasibility Demonstration 1 F33615-96-D-5119	Universal Technology Corporation Wright Patterson AFB, OH	Phil Tydings (937) 255-3701
October 2000	X-Ray Sensors for Real Time Control of Thin Film Deposition F33615-99-C-5702	Technology Assessment & Transfer Incorporated Annapolis, MD	John Jones (937) 255-8786
October 2000	Affordable Manufacturing of Advanced Low Observable (LO) Coatings F33615-98-C-5165	General Atomics Corporation San Diego, CA	Michael Urig (937) 904-4384
October 2000	Concerning the Composite Affordability Initiative F33615-98-3-5106	Northrop Grumman Corporation El Segundo, CA	Dennis Hager (937) 904-4597
October 2000	Concerning the Composites Affordability Initiative (CAI): Phase II - Pervasive Technology/Seattle F33615-98-3-5103	Boeing Company, Defense & Space Group Seattle, WA	Dennis Hager (937) 904-4597
October 2000	Lean Blade Repair Pilot F33615-93-C-4301	General Atomics Corporation San Diego, CA	Rafael Reed (937) 904-4393

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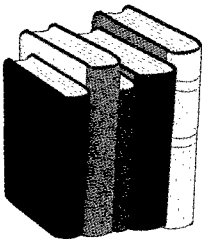
Reports



Military Products From Commercial Lines, Executive Summary
Alog Number: 4295
Contract Number: F33615-93-C-4335
Technical Report Number:
AFRL-ML-WP-TR-1999-4110
Distribution: UNLIMITED

Integrated Substrate and Thin Film Methods
Alog Number: 4268
Contract Number: F33615-98-C-5139
Technical Report Number:
AFRL-ML-WP-TR-1999-4033
Distribution: UNLIMITED

Near Real-Time Monitoring of Thin Film Materials and Their Interfaces Using Evanescent Microwave Probes
Alog Number: 4272
Contract Number: F33615-98-C-5136
Technical Report Number:
AFRL-ML-WP-TR-1999-4074
Distribution: UNLIMITED

New England Supplier Institute (NESI) Final Alternate Deployment Pilot Project Report
Alog Number: 4273
Contract Number: F33615-94-2-4424
Technical Report Number:
AFRL-ML-WP-TR-1999-4075
Distribution: UNLIMITED

Mobile Automated Scanner System (MAUS)
Alog Number: 4292
Contract Number: F33615-91-C-5664
Technical Report Number:
AFRL-ML-WP-TR-1999-4104
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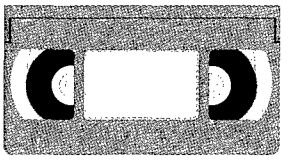

Videos

An Introduction to The Air Force Research Lab
Alog Number: 409
Length: 5:00
Distribution: LIMITED

Process Simulation Tech "What If?"
Alog Number: 408
Length: 9:30
Distribution: LIMITED

Downstream Cost Analysis and Its Implications for Customer Profitability Analysis
Alog Number: 121
Length: 12:35
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Spring 2000

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November 5, 1999

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